

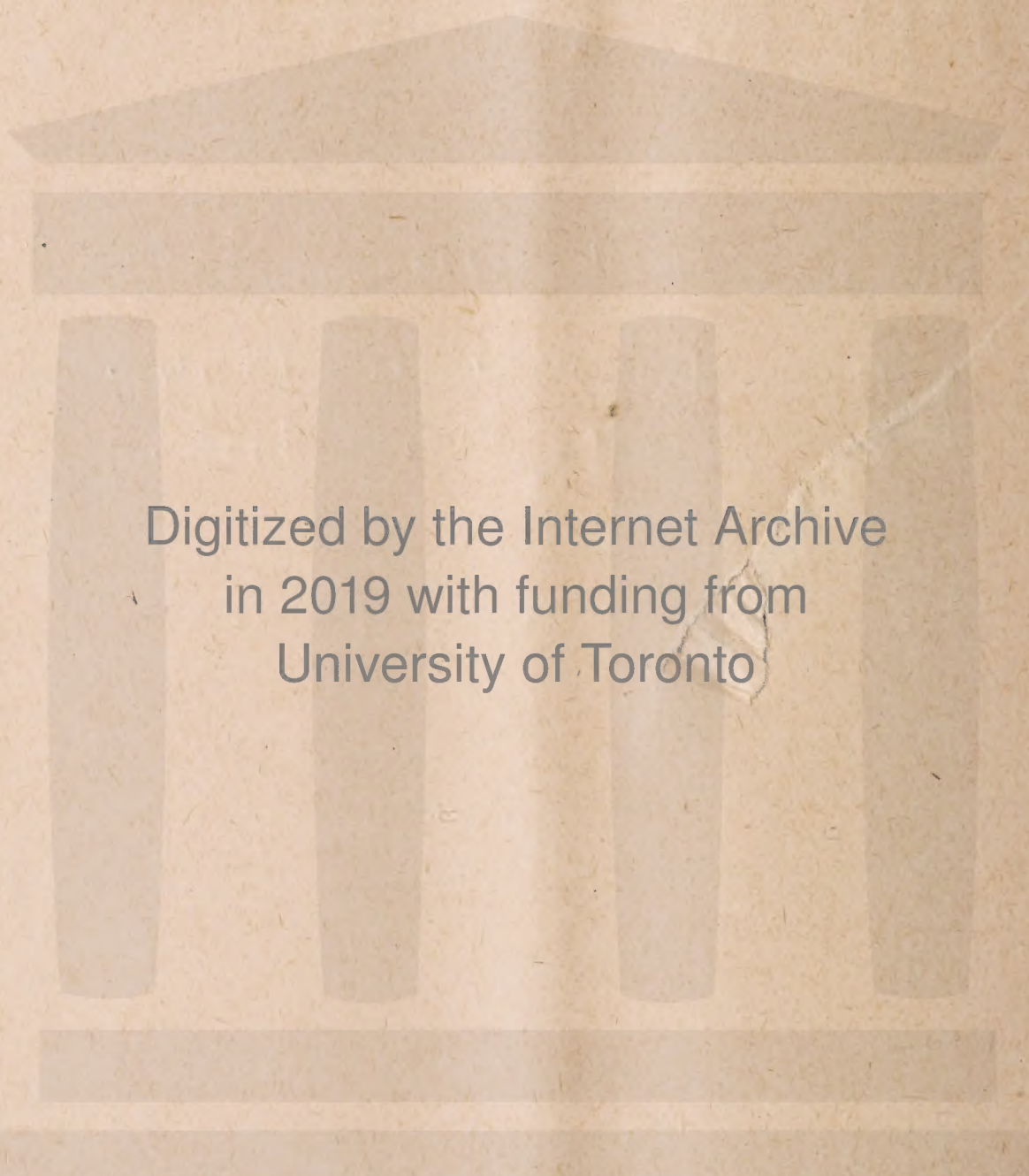
D. M. S. Watson.

Ecology

(McIntosh)

Additions to the Marine Fauna  
of St Andrews since 1874.  
McIntosh.





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Prof. Watson  
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*Additions to the Marine Fauna of St. Andrews since 1874.*  
By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c.,  
Gatty Marine Laboratory, St. Andrews.

[Continued from vol. xix. p. 94.]

### Class CRUSTACEA †.

Of the Branchiopoda, *Evadne nordmanni*, Lovén, is common to both northern and southern areas, and in the Ostracoda twenty-one species are found at St. Andrews, six at Plymouth—all differing from the northern species, which were kindly examined by the late Prof. G. S. Brady. Of the Copepods, twenty-four occur at Plymouth and about nineteen at St. Andrews—such species as *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Centropages typicus*, *Temora longicornis*, *Anomalocera patersoni*, *Acartia longiremis*, *Eutерpe acutifrons*, and *Oithona plumifera* being common to both areas and some in vast numbers. *Halitemora*, *Harpactius*, and *Dactylopus* seem to be more common in the north, *Isias*, *Parapontella*, *Corycaeus*, and *Oncaea* in the south.

It is interesting in connection with the Copepoda that many of the common and most abundant species stretch from the north-eastern shores to the southern waters, and form important elements in the food of the mackerel and other fishes, viz., such Copepods as *Calanus finmarchicus*, *Centropages typicus*, *Pseudocalanus elongatus*, and *Temora longicornis* ‡. Like other marine species many extend to the Mediterranean, where a very large number—both free and parasitic—occur. Dr. Lebour finds that the diatom *Cocinodiscus* is eaten by the Copepods *Calanus*, *Pseudocalanus*, and *Acartia*, and so with other pelagic forms such as *Phaeocystis*.

Some authors, such as Hjort, are inclined to connect the appearance of certain Copepods with waters of different salinities. Thus, *Calanus finmarchicus* and *Pseudocalanus elongatus* are characteristic of water having a high salinity, whereas *Centropages hamatus* and *Halitemora longirostris* are found in waters of low salinity. This view, however, is open to doubt, especially as all these forms are found together in St. Andrews Bay.

† I am indebted to Mr. Andrew Scott of the Piel Laboratory for revising the list of Copepods, Amphipods, and a few others.

‡ G. E. Bullen, Journ. Mar. Biol. Assoc. 1907-10, p. 269.



The Cirripedes are eleven in number at Plymouth, ten at St. Andrews, seven being common to both. The southern forms are *Balanus perforatus*, Brugière, *B. spongicola*, Brown, *Pyrgoma anglicum*, Leach, and *Clithalamus stellatus*, Poli, whilst in the north, *Balanus hameri*, Ascanius, is characteristic.

The Amphipoda of Plymouth are fewer than at St. Andrews (52 against 63), and there are eighteen in common, the southern types—*Mæra*, *Chelura*, *Gamarella*, *Erichthonius*, *Unciola*, *Phtisica*, and *Periambus* being absent at St. Andrews. *Podalirius typicus* is common on *Asterias rubens* in the north.

The Isopods of Plymouth number twenty-nine, whereas at St. Andrews there are nineteen, the species of *Idotea* being more numerous in the north, four being common to both areas. *Apseudis*, *Tanais*, *Anthura*, *Gnathia*, *Rocinela*, *Nerocila*, *Næsa*, *Astacilla*, and *Munna* are more characteristic of the south.

Almost every Order of the British Crustacea is represented by the same species in the Mediterranean, though many additional forms occur, and the same may be said of the Norwegian waters so diligently searched by Prof. G. O. Sars.

The Cumaceæ are more numerous in the south, the only example at St. Andrews being *Diastylis rathkei*, Kroyer. A single example of the Stomapoda is found at Plymouth—none at St. Andrews. The Schizopods are conspicuous at Plymouth, where twenty-four species occur, whereas only six are found at St. Andrews, though some, like *Nyctiphanes* and *Boreophausia*, sometimes are in immense numbers. No less than twenty-four species occur at Plymouth under the Macrura (including the Paguridæ), characteristic types being *Alpheus*, *Anthanas*, *Egeon*, *Nika*, and *Palinurus*. Ten species are present in both areas. At St. Andrews nineteen species of this group are found, noteworthy species being *Lithodes maia*, *Munida bamffi*, and *Nephrops norvegicus*, Leach. The Brachyura number thirty-seven at Plymouth, twenty at St. Andrews, and these twenty are common to both areas. In the north the only characteristic form is *Portumnus variegatus*, Leach, in the south *Dromia*, *Macropodia egyptica*, Milne-Edwards, and *E. longirostris*, *Achæus*, *Maia squinado*, Herbst, *Pisa*, *Eurynome*, *Xantho* indicate the types found in the warmer area.



Order CIRRIPIEDIA.

Suborder OPERCULATA.

*Coronula diadema*, L.

Attached to *Megaptera longimana*, the Tay whale.

Order BRANCHIOPODA.

*Evadne nordmanni*, Lovén.

Abundant in tow-nets.

*Podon leuckarti*, G. O. Sars.

Bottom-net in July.

Order COPEPODA †.

*Calanus finmarchicus*, G. O. Sars.

Abundant in January and continues to December.

*Pseudocalanus elongatus*, Boeck.

Abundant throughout the year.

*Centropages typicus*, Kröyer.

August and September.

*Centropages hamatus*, Lillj.

Numerous. From April to September.

*Temora longicornis*, O. F. Müller.

In July.

*Halitemora longirostris*, O. F. M.

March to December, and often in swarms.

*Anomalocera patersoni*, Templeton.

Chiefly in August.

*Acartia longiremis*, Lilljeborg.

Abundant almost throughout the year.

† Detailed notes of the occurrence of the Copepods are to be found in the 8th Ann. Rep. Fishery Bd. for Scotland, part iii. p. 270.

*Acartia bifilosa*, Giesbr.

Surface-net in September.

*Longipedia coronata*, Claus.

July to October.

*Harpactius chelifer*, O. F. M.

Rare.

*Rhynchothalestris rufocincta*, Norman.

Single example in September.

*Euterpe gracilis*, Claus.

Not common.

*Oithona spinifrons*, Bk. = *O. helgolandica*, Claus

July to October.

*Oithona plumifera*, Baird.

Occasionally.

*Dactylopusia tisboides*, Claus.

Bottom-net, off the Bell Rock.

*Pleopis polyphemoides*, Leuckart.

Bottom-net in July.

*Cyclopina littoralis*, Brady.

Bottom-net in July and August.

*Dias longiremis*, Lilljeborg.

In July.

One Copepod in February (1909) had a parasite projecting from its side a third of its own size and of an elongated form. Unfortunately it was lost.

*Lichmologus agilis*, Leydig.

On *Doris* and *Triopa*.

Family Bopyridæ.

*Phryxus abdominalis*, Rathke.

On *Hippolyte*.



*Bopyrus aquillarum*, Latreille.

Occasionally on *Palæmon*.

*Bopyroides galatheæ*, Bate & Westwood.

On the gills of *Galathea squamifera*.

Order AMPHIPODA.

\**Talitrus locusta*, L.

In the summer evenings swarms leap on the sand near high-water mark, crowding amongst the sea-weeds and decaying animals.

*Janassa capillata*, Rathke.

Frequent.

*Hyperia galba*, Mont.

In enormous numbers off the West Rocks in January.

*Metopa alderi*, Spence Bate.

In tow-nets in June.

*Liljeborgia zetlandica*, Spence Bate.

Occasionally.

*Dulichia porrecta*, Spence Bate.

Not common.

*Parathemisto oblivia*, Kröyer.

It swarms at the surface in winter.

*Cheirocratus sundevalli*, Rathke.

Occasionally.

*Amphilochoides pusillus*, G. O. Sars.

Occasionally.

\**Cerapus difformis*, M. Ed.

It makes remarkable processes, often  $5\frac{5}{8}$  in. long, on *Tubularia indivisa* †, on which it perches itself at or near the tip.

† Ann. & Mag. Nat. Hist. ser. 5, vol. xvi. p. 484 (1885).

*Pariambus typicus*, Kröyer.

Occasionally abundant on *Asterias rubens*.

*Phtisica marina*, Slabber.

Midwater net in May.

Order ISOPODA.

*Idotea granulosa*, H. Rathke.

Not uncommon on seaweed in tidal pools at West Rocks (*W. E. Collinge*).

*Idotea neglecta*, G. O. Sars.

Rather rare (*W. E. C.*).

*Idotea viridis*, Slabber.

Good specimens in pools on the West Rocks (*W. E. C.*).

*Idotea pelagica*, Leach.

Small examples. Rare (*W. E. C.*).

*Idotea emarginata*, O. Fabr.

Common (*W. E. C.*).

*Idotea sarsi*, Collinge.

On seaweed at West Rocks (*W. E. C.*).

*Sphæroma serratum*, O. Fabr.

In brackish pools at Eden (*R. M. Craig* & *W. E. C.*).

*Gnathia maxillaris*, Mont.

Parasitic, fixed at base of dorsal fin of young flounders.

Suborder LEPTOSTRACA.

*Nebalia bipes*, G. O. Sars.

Occasionally.

Suborder CUMACEA.

*Cuma trispinosa*, G. O. Sars.

Several in trawl in June.



\**Diastylis rathkei*, Kröyer.

Many young occurred in bottom tow-net in February.

Order SCHIZOPODA †.

*Thysanoessa longicaudata*, Kröyer.

Occasionally in numbers.

*Nyctiphanes norvegica*, G. O. Sars.

In vast swarms, and occasionally (on 1st May, 1886) beached on the West sands like chaff.

*Rhoda raschii*, M. Sars.

Occasionally in great numbers off the mouth of the Bay.

*Erythrops erythrophthalmus*, Goes.

Summer season.

Order DECAPODA.

Tribe Paguridea.

Family Paguridæ.

\**Pagurus bernhardus*, L.

One in a botanic vasculum inserted itself under the gill-cover of *Cyclopterus* and made such its home.

\**Lithodes maia*, Leach.

The pinkish eggs of a female captured in February hatched on the 11th March. The young have two apparently sessile eyes, a carapace which seems too large and has a projecting point at each side, with a wedge-shaped space between.

*Munida bamffia*, Pennant.

Procured in a crab-pot in the Bay.

Tribe Macrura.

\**Homarus gammarus*, L.

A young example,  $3\frac{5}{8}$  in. long from spine to tail, was found after an easterly gale on the West sands. The longer claw was  $2\frac{5}{8}$  in., the shorter  $1\frac{5}{8}$ , and the tail 2 in. It has been

† For structural notes, vide 'Scott. Naturalist,' May-June 1919, p. 79.



ascertained that in Canada such young forms occupy tubes and thus are rarely seen. In October 1904 the nets of the fishermen caught many lobsters off the East Rocks, some securing as many as ten, to the annoyance of the lobster men, who accused the others of taking their bread.

Tribe *Brachyura*.

*Portunus puber*, L.

Rare. A male caught in the plaice-nets in November.

*Portunus holsatus*, O. Fabr.

Very destructive to the flounder and other nets in the Bay, where it abounds.

\**Ebalia tuberosa*, Penn.

In the male the carapace is brownish red on the dorsum, and touches of red also occur on the chelæ and other parts.

\**Cancer pagurus*, L.

A female procured on 26th February, 1903, carrying a mass of early ova of a bright cinnabar-red kept its chelæ doubled over them with the dactylopodite pressed amongst them, and made no effort to seize the fingers when touched. The late Dr. James R. Tosh described a peculiar example of July 1896, in which the right chela, while having the dactylopodite normal, had the tip of the propodite bluntly trifid, the dactylopodite biting between an outer process and an inner one.

It is curious that at Gairloch every crab is crushed, as the men only take lobsters, for which in 1894 they received 10s. a dozen.

A considerable destruction of edible crabs, from 3 in. across and upward, occurs with the cod- and flounder-nets.

Larval decapods eat larval mollusks, echinoderms, diatoms, and coccospheres (*Lebour*).

Suborder *SCHIZOPODA*.

*Schistomysis ornata*, G. O. Sars.

Near the mouth of the Bay. Occasionally.

Class *PYCNOGONIDA*.

In this group eight occur at Plymouth, and only two are entered in the St. Andrews list.



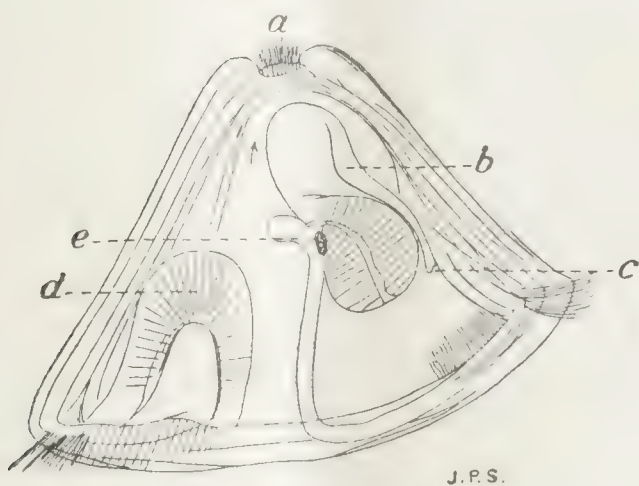
## Class BRYOZOA †.

One hundred and four species of Bryozoa are included in the area at Plymouth, sixty-two at St. Andrews, and of these numbers thirty-seven are common to both areas. The species of *Crisia*, *Caberea*, *Tubulipora*, and *Stromatopora* are prominent in the south, along with *Amathia*, *Triticella*, and *Cylindraceum*; whilst at St. Andrews *Cellaria farciminoides*, *Gemellaria loricata*, *Bugula purpurotincta*, *B. murrayana*, *Flustra foliacea*, *F. truncata*, *Lepralia reticulata*, *L. granifera*, *L. nitida*, and *L. annulata* are characteristic. Only the *Actinotrocha* stage of *Phoronis* has been found at St. Andrews. The Mediterranean is extremely rich in this group, and is also distinguished by its Terebratulids.

\**Cellularia farciminoides*, Ellis & Solander.

This form, like certain Hydroids, grows with considerable rapidity, as for instance, on the bark of a submerged birch-tree, where it covered a large area of continuous and sound bark.

Text-fig. 37.



Text-fig. 37 a.

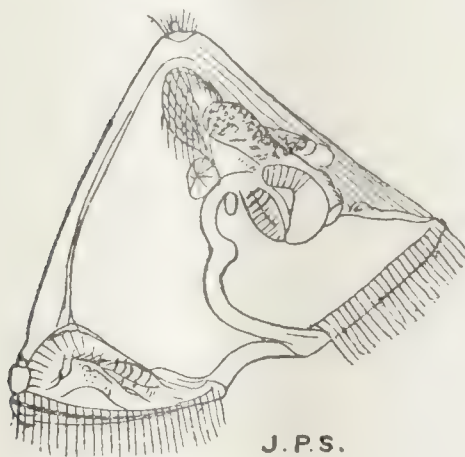


Fig. 37.—*Cyphonautes* as described in the text. Magnified.  
Fig. 37 a.—An example showing the long cilia of the margin. Magnified.

† Journ. Mar. Biol. Assoc. iv. p. 171.



\**Membranipora membranacea*, L.

The larval *Cyphonautes* abounds in the pelagic fauna of the Bay almost throughout the year, and is entered as from February to December.

It devours diatoms (*Lebour*). The examples (text-figs. 37 & 37 *a*) figured by Mr. Pentland Smith, M.A., were procured at the surface in July. The ciliated aboral disc (*a*) has near it the musculo-neural tract of some authors. The ectoderm lines the valves of the shell. The mouth (following the arrow) leads to the stomach (*b*), the intestine terminating in the vent at *c*; *d*, the pyriform organ with its cavity and vibratile tuft; *e*, adductor muscle of the valves; the mantle lines the shell.

## Genus PHORONIS.

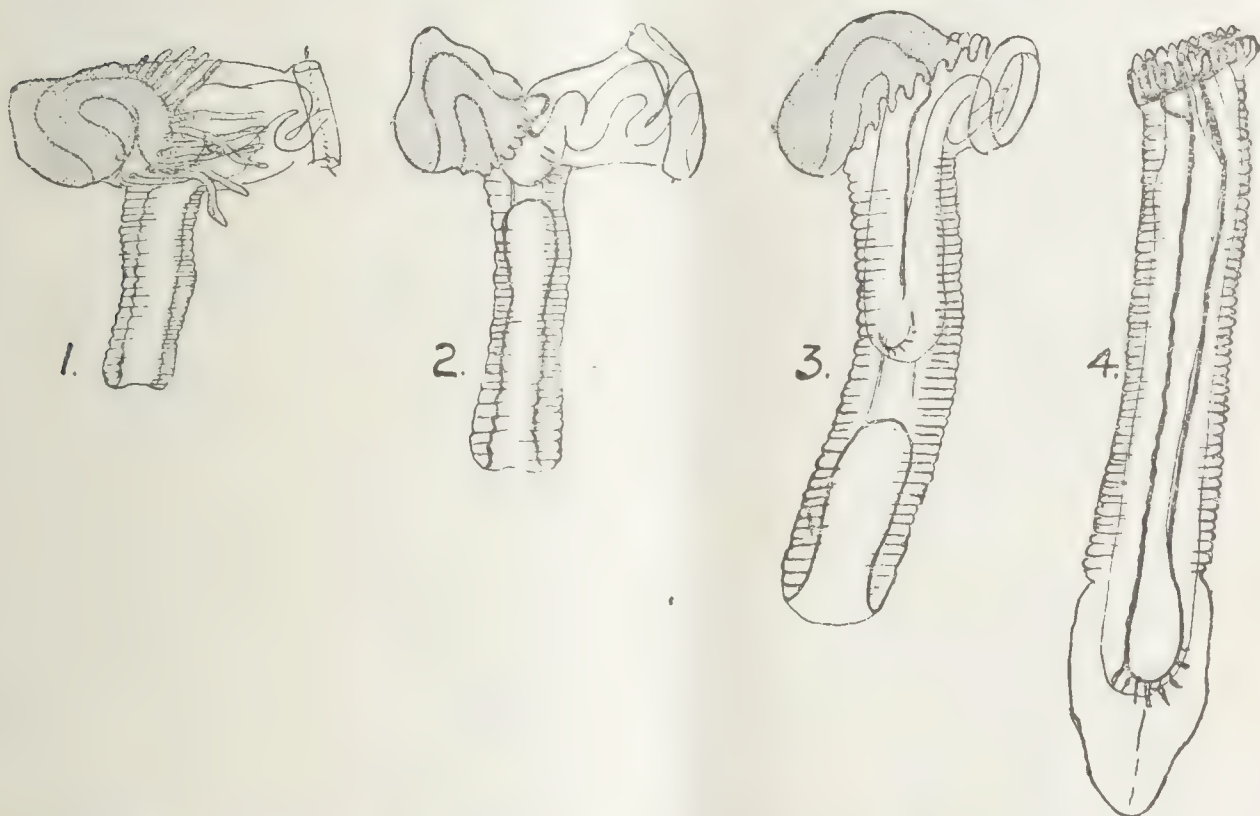
Though the adults have never been captured in the Bay, the larval *Actinotrocha* (text-fig. 38), which Dr. Cobbold formerly found in the Forth, abounds in July and August, and has been specially studied by Prof. Meek and Dr. Masterman. It has been got as late as September at Plymouth, where Dr. Lebour found it fed on Peridinians and diatoms. Two species, viz. *Phoronis ovalis* and *P. hippocrepia*, were found by Dr. Strethill Wright in the Forth, and in all probability our form pertains to one of these. Both occur in shells, and Sir Sidney Harmer thinks they occupy the canals made by boring algæ. Early in 1884 a species swarmed in fragments of chalk sent by Mr. Shrubsole from S. England. Whether an alga had preceded the *Phoronis* in this case is unknown. The species found at Plymouth is *P. hippocrepia* and is classed by Prof. Garstang as a Gephyrean.

No marine form is more remarkable than *Phoronis* for beauty and life-history. The hooded larval form shows a series of finely coloured tentacles, which are richly ciliated, and an aperture at either end. It is carried gaily about in the water. When transformation is about to take place an inpushing appears at one side developing into a long coiled tube (text-fig. 38, 1 & 2), the animal still remaining pelagic and developing new tentacles at the base of the old. Then it becomes quiescent, sinks to the bottom, and suddenly the long internal tube begins to unroll like the turning of the finger of a glove inside out. The body, formerly so short, becomes elongated, and the mouth and vent, instead of being at opposite poles, are now brought



near each other, whilst the stomach and alimentary canal slip into the long tube (text-fig. 38, 3 & 4). The hood and the central nervous system in it are absorbed (or swallowed?), and hence the peculiar nature of that part of the nervous system which remains.

Text-fig. 38.



Metamorphosis of *Phoronis*; 1 & 2 show the earlier stages, 3 & 4 the later stages.

(Block kindly lent by Prof. Meek.)

### Phylum **MOLLUSCA**.

The Pelecypoda are numerous in both localities, eighty-six being entered for Plymouth, seventy-three for St. Andrews, and fifty-three are common to both areas. *Mytilus modiolus* is absent in the south, where *M. barbata*, L., is present. *Gastrochæna*, *Pandora*, *Diplodonta*, *Cochlodesma*, *Gari*, and *Meretrix* are characteristic. The species of *Pholas* diverge as do those of *Thracia*, and *Lima hians* is absent from St. Andrews, the two species found there pertaining to deep water. Amongst characteristic forms at St. Andrews are *Crenella decussata*, Montagu, *Leda minuta*, O. F. M., *Lasæa rubra*, Mont., *Axinus flexuosus*, Mont., *Montacuta bidentata*, Mont., *M. ferruginea*, Mont., *Cyamium minutum*, Fabr., *Cardium norvegicum*, Spengler, *Astarte sulcata*, Da Costa. The species of *Modiolaria* and



*Scrobicularia* are more numerous ; there are no Pulmonates ; *Mya arenaria*, L., is common and *Xylophaga dorsalis*, Turton, occurs in submerged wood. A single Scaphopod (*Dentalium entalis*, L.) is present in both areas.

Most of the British Pelecypoda frequent the Mediterranean, which also is the home of the large *Pinna* and the boring *Lithodomus*.

The Prosobranchiates number seventy-seven at Plymouth, fifty-four at St. Andrews, twenty-five of which are common to both places. Southern types are *Fissurella*, *Monodonta*, *Calliostoma*, *Phasianella*, various Rissoidæ, *Ovula*, the Cerithiidæ, Scalidæ, *Cæcum*, *Ocenebra*, and *Mangilia*. At St. Andrews characteristic forms are *Tectura*, *Hydrobia*, *Homologyra*, certain Pyramellidæ, *Natica catena*, and *Nassa*; seventeen Tectibranchs occur at Plymouth, only eight at St. Andrews, seven being common to both. Southern types at Plymouth are *Haminea*, *Rocania*, *Colpodaspis*, *Pleurobranchus*, *Oscanius*, and *Runcina*. The Nudibranchs are especially prominent at Plymouth, no less than sixty-eight being entered, whilst the number found at St. Andrews is twenty-nine; about twenty are common to both regions. The number of southern types at Plymouth is considerable, including *Hermæa*, *Stiliger*, *Elysia*, *Æolidella*, *Berghia*, *Cythona*, *Carolina*, *Embletonia*, *Amphorina*, *Favorinus*, *Calma*, *Hero*, the Lomanotidæ, *Hancockia*, *Platydoris*, and *Lamellidoris*. *Eolis faranni*, Ald. & Hancock, *E. adelaidæ*, A. & H., and *Doris repanda*, A. & H., are characteristic of St. Andrews.

The Cephalopoda are few at St. Andrews, only five in number in contrast with eleven at Plymouth. The two common to both areas are *Loligo forbesii*, Steenstrup, and *Moschites* (*Eledone*) *cirrosa*, Lamk. The common form at St. Andrews is *Ommastrephes todarus*, Delle Chiaje.

The waters of the Mediterranean, again, are richer in the Aplysiidæ, *Tethys*, *Phyllirhoë*, *Haliotis*, *Turbo*, *Gibbula*, *Vermetus*, *Atlanta*, *Cymbulia*, and in the Cephalopods, besides having most of the British species.

\**Ostrea edulis*, L.

Various suggestions have been made as to the establishment of an oyster-bed at St. Andrews, but the single fact that the temperature is inimical disposes of the idea. Even those in the estuary of the Forth have undergone serious degeneration, chiefly from the ever-increasing impurity of the water. Those in October 1895 were thick-shelled and coloured green externally, many perforated by the boring

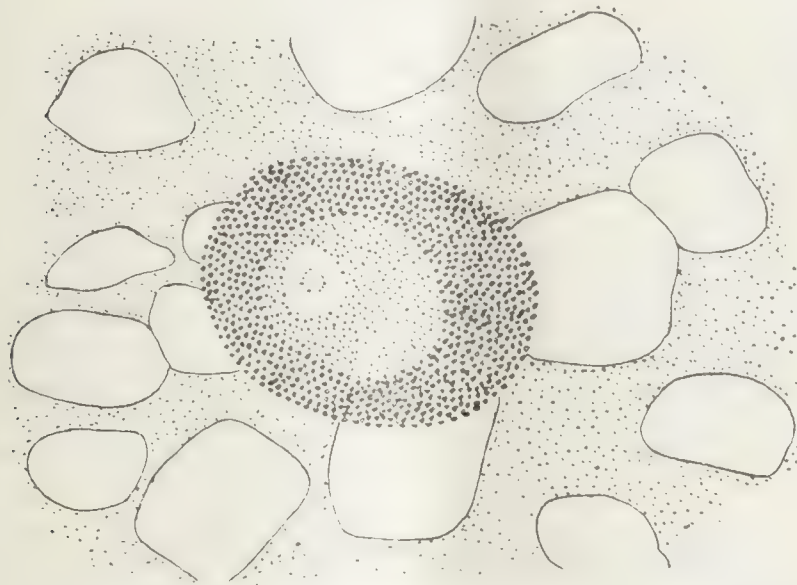


sponge *Cliona*, and the animals shrunken and a few distorted. Altogether they were in an unsatisfactory condition. One, however, had well-developed ova. The native oysters from Whitstable also suffer much from *Cliona* and *Polydora*, the latter piercing the shell and causing blackish blotches and stains internally. It is difficult to see how any chemical substance applied to the exterior could be of service—from the risk to the oyster itself. The Whitstable beds likewise harbour on the oyster-shells *Eteone*, *Eulalia*, *Cirratulus*, *Dodecaceria*, *Pholoë*, Syllids, *Polycirrus*, etc.

*\*Mytilus edulis*, L.†.

The pelagic young form an important element in the food of all kinds of young fishes in the Bay, and the supply to the older forms is continued after their attachment. The extensive beds of the estuary of the river Eden continue to be as

Text-fig. 39.



Ovum of *Mytilus edulis* in the tissues.  $\times 400$  diam.

fruitful as formerly under the trained staff of the Town Council. The mud collected by the masses of mussels beyond low-water mark raises the beds here and there several feet in the air, but after they are gathered the current soon lowers the surface to the normal level. The Fishery Board for Scotland, by the advice of Mr. Cumyn, attempted to increase the supply by establishing the “bouchot”-system in the Eden. Heavy larch-posts with wattles were erected in due form, but in a short time a severe storm swept the whole

† E. W. D. Holt, Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 184; Dr. John Wilson, “On the Development of the Mussel,” 4th Rep. S. F. B.



erection into the Bay. The mussels spawn from January to July †. Pearls are not uncommon in them ‡. An ovum in the tissues is shown in text-fig. 39.

Examples sent out a thread of mucus from the gut, containing diatoms, sponge-spicules, minute algæ, organic débris, sand, and mud. The young mussels usually appear in the bottom tow-nets at the beginning of June. The reproductive organs of examples from the West Coast of Scotland were well advanced at the end of January. This species is a commensal in the eye-sockets and on the swimmerets of the shore-crab, and on the gills of the haddock.

\**Mytilus modiolus*, L.

The males are recognized by their pale reproductive organs, those of the female are dull orange. A hermaphrodite example has been seen §. Though the fishermen have often laid them down near the rocky border, none survived there. Rarely a stunted form has been found amongst the rocks.

\**Modiolaria marmorata*, Forbes.

The ova are well developed in July.

\**Montacuta bidentata*, Montagu.

The distinguished malacologist, Prof. Pelsener, of Brussels, has shown that this species is a commensal in various Lamelli-branches, such as *Pholas candida*, *Mya*, *Erycina*, etc., whilst others of the genus occur on *Phascolosoma* and *Phascolion*.

*Montacuta substriata*, Montagu.

Abundant on *Spatangus purpureus* dredged off the Bell Rock.

\**Cardium edule*.

On May 29th, 1891, the males had the sperm-sacs fairly developed, but no ripe sperms. In the females the ovisacs were distended, though the ova were not quite ripe (text-fig. 40). The nuclei were large and the nucleolus well marked as a clear round body. They would seem to spawn in June, probably later than the mussel.

† *Vide* Ann. & Mag. Nat. Hist., Dec. 1888, p. 467.

‡ *Op. cit.*, June 1903.

§ Ann. & Mag. Nat. Hist., Sept. 1894, p. 196.



Text-fig. 40.



Portion of the ovary of the cockle.  $\times 360$  diam.

*\*Cyprina islandica, L.*

In the beginning of November 1903, the West Sands were strewn with multitudes of this species, only few or no others being present. How they were dislodged by the storm without interference with others is a mystery. Large numbers were salted for bait and used with such success that on the great lines the fishermen in most of the boats got eight boxes of cod in the Bay. Prof. Cleland found *Malacobdella grossa* in it in April.

*\*Astarte sulcata, Da Costa.*

The ova in July were about  $\frac{1}{100}$  inch in diameter.

*\*Astarte compressa, Montagu.*

Sperms (pale yellowish in mass) fully developed in July, the head being wedge-shaped.

*Thracia convexa, Wood.*

Procured by Dr. MacTier in numbers on the West Sands north of the Club-House.

*\*Saxicava rugosa, L.*

Specimens  $\frac{4}{5}$  of an inch in July had minute ova  $\frac{3}{1000}$  to  $\frac{1}{500}$  of an inch and few in number.



*\*Pholas candida*, L.

Hundreds were strewn on the West Sands in a more or less perfect condition after the drainage blasting operations at the West Rocks, and were picked up by Dr. MacTier. Previously only single valves, as a rule, were obtained occasionally.

*Teredo navalis*, L.

Occasionally on floating timber.

Class GASTROPODA.

*Trochus helycinus*, O. Fabr.

Abundant on zoophytes and tangle-blades at and near extreme low water, Pier Rocks.

*\*Lamellaria perspicua*, L.

The *Atlanta*-like larva is not uncommon in June and July amongst the pelagic forms.

*\*Natica catena*, Da Costa.

A coil of ova was deposited by one the 17th of November.

*\*Buccinum undatum*, L.

The egg-capsules of the littoral examples are smaller than those in deep water, probably because the latter are larger animals. It is destructive to fishes on the lines, and is occasionally captured when so engaged by a hook.

Suborder NUDIBRANCHIATA.

*Pleurophyllidia loveni*, Bergh.

On haddock-lines near the mouth of the Bay in April (*E. W. Holt* †).

*Idalia aspersa*, Ald. & Hancock.

One occurred on 13th Oct., 1890. Procured also in the test of a broken *Molgula* from the fishing-boats in March (*E. W. Holt* †). This form is said to feed on Ascidians ‡.

*\*Tritonia hombergii*, Cuv.

A white variety from the Bell Rock was got by Mr. Holt †.

† Ann. & Mag. Nat. Hist. ser. 6, vol. viii. p. 184.

‡ Archiv Zool. Expér. no. 1, 1893.



*Doris diaphana*, Ald. & Hancock.

Occasionally at the East Rocks.

## Class PTEROPODA.

*Clione borealis*, Pallas.

Captured occasionally in April, June, and July. The body is translucent, and from the anterior end a median bar of reddish orange goes backward behind the epipodia, which glisten with file-like marks, from the muscles. The tip of the tail is marked with reddish brown, which under the microscope is flecked with large pigment-cells. A small median process projects in front. The tentacles are pale. Two nuchal processes occur on the neck in front of the epipodia and a little median tentacle behind. The heart lies behind the orange region. Some show a small pale process at the tip of the tail. They swim actively and gracefully in the water.

Another form resembling *Clione* had a bifid anterior segment in front of the ring of cilia, each division having a rounded flat papilla with palprocils somewhat resembling *Pneumodermon*. There is a median as well as a caudal ring of cilia. When viewed from the dorsum the outline is symmetrical, but when turned round it presents two lamellar processes (apparently epipodia), with a structure like a tentacle behind. The central region is opaque whitish, not pink as in the previous form. It is about the same length. It differs from the larval *Dentalium* with its trifid anterior region, as carefully figured by Lacaze Duthiers †.

Text-fig. 41.



Unknown pelagic structure from the bottom tow-net in July.  
Magnified.

A minute pelagic form (text-fig. 41) from the bottom tow-net in July probably belongs to a known species which shows certain changes during development; whilst another represents a common type of veliger abounding towards the end of the year.

† Ann. Sci. Nat. (4) t. vi. & vii.



*Spirialis retroversus*, Mtrs., = *Limacina trochiformis*, Gray.

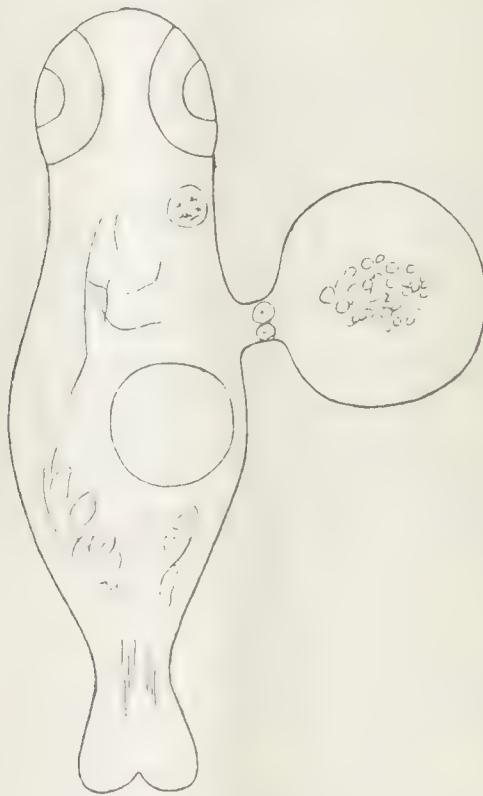
Many young forms in the nets in July, and occasionally earlier in the year.

### Class CEPHALOPODA.

*Loligo forbesii*, Steenstrup.

For nearly a fortnight, along with *Eledone*, in November 1891 they caused serious injuries to fishes (cod, haddock, and whiting) on the lines, removing the muscles behind the head and 3 or 4 inches backward, whilst in others the brain is removed and the liver taken out, but the stomach and intestine are not interfered with. The rasp-like odontophore

Text-fig. 42.



Young cuttlefish from the bottom-net in May. Magnified.

removes the muscles neatly, but shreds of skin hang to the wound. The fishes are useless for sale, but make bait for crab-pots. An extensive area from the Bell Rock to the Island of May and ten miles E. and W. was thus infested. The bottom-net on May 24th brought several young cuttlefishes (text-fig. 42) with yolk-mass attached. They were greedily devoured by *Hybochodon*. The egg-capsules had in all probability been ruptured in capture.



\**Sepiola rondeletii*, Leach.

A male in June had numerous beautifully shaped spermatophores.

\**Ommastrephes todarus*, Steenstrup.

A young example, 1 inch long, was procured in the bottom-net on the 8th March. A large cuttlefish, having a body about two feet long, was stranded on the East Rocks and was found by Mr. Andrew Brown, M.A. It was much destroyed by gulls, but, so far as can be observed, it is allied to *Stenoteuthis*. The ova of other forms are occasionally procured off the Bay as well as within it.

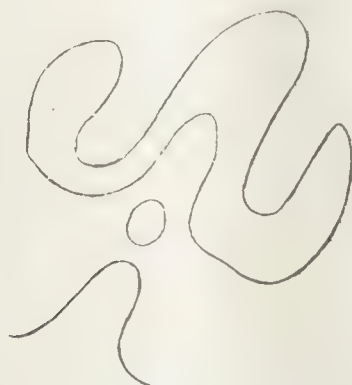
Subphylum **ENTEROPNEUSTA.**

*Balanoglossus* sp.

No adult has been seen, but the *Tornaria*-larva† is not infrequently captured, generally in August, and it has been studied by Prof. Meek and Mr. Holt. At Plymouth it occurs from August to September.

The larval *Tornaria krohnii* was procured at Plymouth by Prof. G. C. Bourne† in August and September, and he gives a detailed account of its structure.

Text-fig. 43.



The pre- and post-oral ciliated bands of *Tornaria*.

Sketched by Prof. Meek.

The fully-developed *Tornaria* (of 6th August, 1890) shows the apical sense-organ (pigment-spot), the inner loop of the pre-oral band, the median loop, the lateral loop of the longitudinal band, median loop of the longitudinal band (*more* Prof. C. G. Bourne), mouth, water vascular vesicle and pore, anus, mid-gut, hind-gut. Prof. Meek in text-fig. 43 gives an outline of the relation of the pre-oral and post-oral ciliated bands to the mouth.

† Journ. Mar. Biol. Assoc. n. ser. vol. i. p. 63, pls. vii. & viii. (1889).



Subphylum **TUNICATA.**

## Order ASCIDIÆ COPELATÆ.

Thirty-six species occur under the Tunicates at Plymouth, fifteen at St. Andrews, and only seven or eight are common to both. The southern species of *Molgula* differ, *Polycarpa* and *Corella*, *Diazona*, *Perophora*, *Distaplia*, *Archidostoma*, *Morchellia*, *Morchellioides*, *Fragrarium*, *Circinalium*, *Doliolum*, and *Salpa* are southern; whilst *Leptoclinum*, *Botrylloides*, *Parascidia*, and *Pelonaia* are northern. Many of the northern forms range to the Mediterranean, such types as *Eugyra*, *Ctenicella*, and *Rhodosoma* are apparently southern, as also are *Scarobotrylloides*, *Cystodytes*, *Distaplia*, *Fragrarium*, and others of the Composite series.

Text-fig. 44.

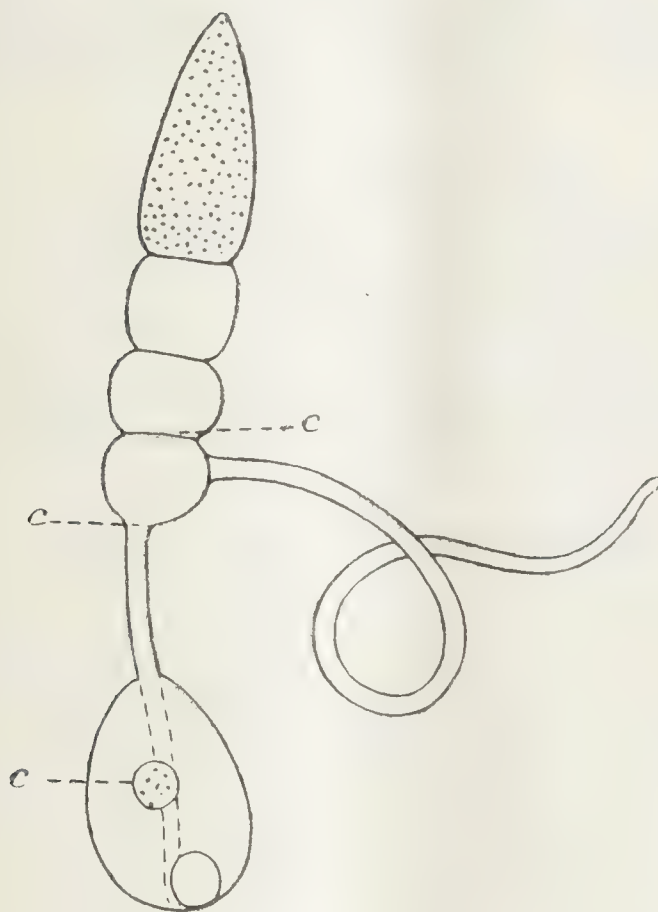
Lateral and end views of *Oikopleura*.



*Oikopleura dioica*, Fol.

Occurs in vast multitudes in the Bay (text-fig. 44), especially in May, so that the large midwater-net forming a triangle 10 feet along each side and 24 feet long could not be worked and anchored the boat. The fœcal pellets seemed to be algoid, consisting of diatoms, greenish granular matter, a few fragments of *Rhizosolenia*, and yellowish grains. It probably also feeds on the peculiar algoid bodies described in the Report of the Fishery Board †. *Oikopleura* often

Text-fig. 45.

Peculiar form amongst crowds of *Oikopleuræ* in February.

occurs at the surface or in 4, 6, and 8 fathoms along with ephyrae of *Aurelia*, small forms of *Thaumantias*, *Aglantha*, *Lestrigonus*, and small flounders. Once 2 fathoms of the surface-region was held by dense masses of *Rhizosolenia*, whilst *Oikopleura* swarmed in the region below. It is often eaten by Medusæ. Amongst those captured in February 1891, the accompanying form (text-fig. 45) occurred. The pointed anterior end is granular and is followed by three segments, the third having a long filament attached to its lateral region, whilst it is continued posteriorly by a narrow

† S. F. B. 7th Rep. p. 271, pl. v. figs. 1-4.



process into a flattened ovoid body with a central ciliated structure. In the sketch *c* indicates where cilia existed. The exact nature of this larval form has not yet been determined.

At Plymouth *Salpa* and *Doliolum* are not uncommon, whereas these never appear at St. Andrews, and the same may be said of *Phoronis*, only the larva of which occurs at St. Andrews. *Oikopleura*, again, abounds in June and July.

#### Order ASCIDIÆ SIMPLICES.

*Molgula impura*, ? Hellier.

This form resembles a strawberry. West Sands after a storm (*E. M.*).

### FISHES.

#### Subclass I. LEPTOCARDII.

A re-examination of the fragments found in the stomach of a cod makes the entry of *Branchiostoma lanceolatum*, Pall., uncertain. It is, therefore, removed from the list.

#### Subclass II. CYCLOSTOMATA.

\**Petromyzon marinus*, L.

The ova were sent by Dr. Fulton on 19th March, 1892. They measured  $\cdot 7620 \times \cdot 6096$  mm. Nowhere are the adults so well seen as at Galway Bridge attached to stones.

\**Myxine glutinosa*, L.

In 1884-5 this form was frequently found in the harbour alive, the hook being fixed far backward, and the "snood" (hair-line) projecting from the mouth. They were procured by the fishermen at the "Eel-hole" 8-10 miles off St. Abb's Head. Another site is east of the Isle of St. May. Both are muddy. The men dislike to touch them as the mucus clings tenaciously to the hands, so they break the "snood" and throw them overboard. Some had large ova, others small, in July. During the Trawling Expeditions, the skins and skeletons of Green Cod and Cod were sometimes drawn up, the muscles and other parts having been removed by *Myxine*.

Subclass III. TELEOSTEI.

Order ACANTHOPTERYGII.

Family Percidæ.

*Labrax lupus*, Cuv. The Bass.

A large example, weighing about 7 lbs. and measuring 2 feet 2 inches, was captured in the salmon stake-nets off the eastern rocks, and a smaller in a sweep-net for the capture of sea-trout in the estuary of the Eden, and measuring 17 inches in length. This fish is said to be scarce in Scotland, and is seldom or never captured by the liners. Both occurred in the beginning of May.

\**Cottus scorpius*, Bloch.

An example, attempting to swallow a herring longer than itself, is in the Museum.

\**Gasterosteus spinachia*, L.

The interesting nests occur in pools not far from high-water mark at the Castle Rocks in May†. A nest has been found in the same pool for several years.

*Cottus quadricornis*, L.

A fine example was caught by a liner, and also got in the Trawling Expeditions in 1884.

\**Trigla hirundo*, Bl.

On 18th July, 1888, the ovaries in one 19 $\frac{3}{4}$  in. long were enlarged, the best developed eggs measuring ·031 mm.

*Sebastes norvegicus*, O. F. M.

A specimen, 17 inches long, was caught in the nets 11th January, 1904.

\**Lampris luna*, Retzius.

Though the example in the University Museum is labelled as from the Bay, such appears to be doubtful.

*Gobius minutus*, Gmel.

Common in the harbour and in the Bay.

† *Vide* Frontispiece by E. E. Prince, 'British Marine Food-Fishes,' McIntosh & Masterman, 1897.



*Aphia pellucida*, Nardo.

A young form in tow-net near the surface, 23rd July, 1903. Rare.

*Crystallogobius nilssoni*, Dub. & Kor.

Young in midwater-net off the Tay, 20th February, 1889.

\**Cyclopterus lumpus*, Artedi.

Caught in great numbers in the salmon stake-nets both at the East rocks and West Sands. The nets have sometimes to be opened lest the masses should rupture them.

Family *Pediculati*.

\**Lophius piscatorius*, L.

Long bands of the ova were entangled in the salmon stake-nets on the 10th July, 1891.

Family *Blenniidæ*.

\**Anarrhichas lupus*, L. †.

Masses of the ova occur in the Bay in January, and perhaps might be found earlier. They were procured by the local trawlers in 1886. Young forms appear about the end of February.

\**Blennius pholis*, L.

A female ‡ deposited ova in confinement. The ova have not hitherto been seen amongst the rocks, though the young are common in the rock-pools.

\**Centronotus gunellus* §.

The masses of ova are found in March in cavities in the rocks, such as the holes of *Pholas*, the adult being coiled around them.

\**Zoarces viviparus*, L.

The structure of the papillæ in the ovary is characteristic ||.

† Trans. Roy. Soc. Edinb. vol. xxxv. p. 874.

‡ Zeitsch. f. w. Zool. Bd. lxxxii. p. 38, Taf. 21, 1905.

§ Trans. Roy. Soc. Edin. vol. xxxv. p. 676; and Ann. & Mag. Nat. Hist., Oct. 1887, p. 302.

|| Ann. & Mag. Nat. Hist., June 1885, p. 430, pl. xvi.

*Lumpenus lampetriformis* †.

First found in British waters during the Trawling Expeditions in 1884. Specimens occur in the Bay.

\**Regalecus glesne* ‡, Ascan. (= *R. banksii*).

A fine example was procured on the beach at the Tentsmuir in a fresh condition, and is mounted in the Museum of the University.

*Mugil chelo*, Cuv. §.

The stomach in an example (15½ in.) obtained in June was gizzard-like and contained mussels and sand.

Order ACANTHOPTERYGII PHARYNGOGNATHI.

*Labrus mixtus*, Fries & Ekstrom.

The young abound in the rock-pools in autumn. The remarks under *Labrus maculatus* apply to this species.

Suborder PHYSOSTOMI ABDOMINALES.

Family Scopelidæ.

*Maurolicus pennanti*, Walb.

Occasionally in rock-pools, East Rocks—probably swept in by storms.

Suborder ANACANTHINI.

Family Gadidæ.

\**Gadus callarias*, Cuv.

On the 8th February, 1892, a cod, 30 inches long, had on the left side an irregularity of the lateral line, for it bent down toward the middle in a V-shaped process, whilst a short patch occurred in front of the V and another behind—almost touching the V.

† F. Day, Proc. Zool. Soc. for 1884, p. 445, pl. xli.; and 12th Rep. S. F. B. pl. iii. fig. 10.

‡ Ann. & Mag. Hist., Sept. 1902, p. 252. Vide also *ibid.*, July 1862, R. Walker.

§ 6th Rep. S. F. B. p. 276.



*\*Gadus aeglefinus, L.*

On 16th March, 1892, a haddock, 2 feet long, had a large tumour 7 inches from the tip of the tail†. The fish was considerably atrophied, and the tail on both sides behind the tumour was congested—the colour being that of a red mullet. It was a female and the ovaries were ripening. The melanotic tumour presented an ulcerated surface, and microscopically showed a multitude of small cells with fibroid streaks between them. The liver was small and pale.

*Gadus esmarki, Nilsson.*

Occasionally in the Bay.

*\*Gadus virens, L.*

Active adults, apparently in their rush after prey, occasionally land themselves out of the water on the sand.

*\*Molva vulgaris ‡, Flem.*

A young ling of 3 inches was found alive in the sand at low water, and it had a single lateral band on each side. On the other hand, those of 5–8 inches which are procured off the rocky margins beyond the Pier are boldly barred on the sides. When they reach 18 inches no trace of the bars occurs. Dr. Schmidt therefore considers the barred forms as representing the Blue Ling (*M. byrkelange*), which, however, has never been obtained in British waters. In this connection two examples caught on May 21st, 1907, and measuring respectively  $9\frac{1}{2}$  and  $13\frac{1}{2}$  inches, are interesting. The former had the usual blotches or bars along the sides as described on p. 281 of the 'British Food Fishes.' The pectorals were still golden, the ventrals were pale with white trifid tips. The barbel had blackish pigment. The colour of the dorsal and caudal fins was as noted in the book referred to. In the larger example, the chief changes are the elongation of the snout in front of the eyes, the increase of the space between the eye and the nostril, and also an increase between the nostrils and the tip of the snout. The coloration is still like that of the younger specimen. The median division of the tip of the ventrals is longer and broader. The tail shows the pigment bars less boldly, though the margin is still white. The inner whitish curve is rather less.

† 10th Rep. S. F. B. pl. xvii. fig. 1.

‡ Ann. & Mag. Nat. Hist., January 1906.

*Merlucius vulgaris*, Flem. Hake.

Fine examples, 3 feet long, are occasionally caught in the Bay in March.

*Phycis blennioides*, Brün. Greater Fork-Beard.

An example, 2 feet long, was procured in March. It is occasionally caught in the Bay.

*Motella tricirrata*, Bl.

A fine example in the University Museum, about 18 inches long, was caught in the Bay in 1924.

Suborder **PLEURONECTOIDEI.**

*Hippoglossoides limandoides*, Bloch. Long Rough Dab.

Common in the Bay.

\**Rhombus maximus*, Will.

No less than about a dozen turbot, deeply coloured on both sides, were procured in the nets for plaice in 1902. All had a deep notch in the skull anteriorly, so that the dorsal fin arose from a peak. The eyes were on the left side, the right eye being close to the margin. The right side had a few prickles. The length of the examples ranged from 9 to 14 inches †.

*Zeugopterus punctatus*, Bl.

Occasionally in the eastern part of the Bay. One stranded after a storm in January measured 72 mm.

*Zeugopterus novegicus*, Gthr.

A specimen, 84 mm. long, tossed on the East Sands after a storm in January 1895.

\**Pleuronectes platessa*, L.

Parti-coloured plaice are not uncommon, and some have tumours.

† Ann. & Mag. Nat. Hist., April & Sept. 1902. *Vide* the same for plaice and other Pleuronectids; *vide* also for tumour on plaice, *ibid.*, May 1908; and for abnormal fins, *ibid.*, Dec. 1908.



\**Solea lutea*, Bp.

This is referred to in the former list as *S. minuta*.

Suborder PHYSOSTOMI ABDOMINALES.

\**Salmo trutta*, L.

After the sewage-pipe from the city was laid (the discharge being at the West Rocks) salmon-trout were observed to be more numerous at that part.

Family Scomberesocidæ.

\**Belone vulgaris*, Flem.

An angler at Guard Bridge was much astonished at the capture of a fine example there, and thinking it was a kind of snake wrapped it carefully up and brought it to St. Andrews.

*Scomber scomber*, L.

A large mackerel is occasionally thrown on the East Sands in February, but it is a rare fish at St. Andrews, especially at that season.

*Thynnus thynnus*, L. †.

An old male weighing about 6 cwt. was caught in the neighbourhood in October 1885. The gills had tufts of *Obelia* and parasites on them.

*Caranx trachurus*, Cuv. & Val.

An occasional visitor. Caught in the sprat-nets near the mouth of the Tay.

Family Clupeidæ.

\**Clupea harengus*, L.

It was not known that the herrings spawned in the Bay until the bottom-nets of the Laboratory found the entire Bay peopled with larval herrings, like fragments of thread, in March.

† Rep. S. B. (4th) p. 206, Appendix.

Suborder PHYSOSTOMI APODES.

*Muræna helenæ*, L.

An example was caught in a sprat-net near the mouth of the Tay, January 1901.

\**Anguilla vulgaris*, Turt.

The metamorphosed young are occasionally found in the sand at low water. *Leptocephali* from the neighbourhood of the Bay were given to Dr. Gunther for the British Museum in 1867.

\**Conger vulgaris*, Cuv.

During very severe frosts (as in January and February 1886) large examples (4-5 feet long) were thrown on the East Sands. Apparently extreme cold is inimical in comparatively shallow water.

Order LOPHOBRANCHII.

*Nerophis ophidium*, L.

Not infrequent.

Subclass GANOIDEI.

Order CHONDROSTEI.

\**Acipenser sturio*, L.

Most of the specimens caught in the Bay have been young, though in October 1904 one was 5 feet 8 inches long.

Order PLAGIOSTOMI.

\**Galeus vulgaris*, Flem.

The majority of the examples seem to have been obtained in October and November. On November 2nd a female of 5 feet had a good-sized cod in its stomach, devoid of the head (which they are said to bite off), and a few small stones, to which anemones may have been fixed. The ovary contained large ova, about 2 inches in diameter, arranged roughly in three rows. They would soon be ready to enter the oviduct. The bilobed liver was greyish.



*Lamna cornubica*, Flem.

Of late years when the fishermen put nets for plaice and other fishes in the Bay, this shark has frequently been caught—sometimes as many as thirty or more in a season (October to December). Where lines are set they seem to pass along the series and bite the snoods, which they swallow with the haddocks. Some of the females are 9 feet in length and of a wide girth. Since the pyloric opening only admits a crow-quill, bones and coarse débris must be got rid of otherwise. The total length of the alimentary canal from the œsophageal opening to the vent in a female of 7 feet 3 inches was 4 feet, the large intestine was only 16 inches. They often roll the trammel-nets round their bodies in their struggles, and some are dead when discovered. The teeth of this species are sharp and long, and inflict deep wounds on their larger prey. They have never been known to attack the human subject. One example had a gaping aperture in the hyoidean region, probably caused by the tearing outward of a large hook †.

\**Acanthias vulgaris*, Risso.

A large female had a hook about 3 inches long projecting through the pericardium, and on examination the heart was still pulsating regularly, the point of the hook touching the ventricle at each contraction, and the surface of the pericardium was covered with a purulent coating; yet the stomach of the fish contained several haddocks, and the animal was well nourished.

*Alopias vulpes*, Bp. ‡.

A fine example measuring 14 feet from tip to tip was caught in a trawl off the Bay, and its muscles formed a dinner for the students and others. It tasted like lobster. Its stomach was filled with "green bones" (*Belone vulgaris*).

Suborder **BATOIDEI**.\**Raia clavata*, L.

The spawning-period seems to be extended, most of the eggs cast on the West Sands (north end) after storms being of various stages in November, some early, others advanced

† Ann. & Mag. Nat. Hist., Sept. 1907, p. 169, pl. xvii.

‡ *Op. cit.*, Sept. 1902, p. 255.

with the external gills, and one example deposited two capsules in March. The oldest fisherman knew no change in this species as regards distribution inside low-water mark.

*\*Raia batis*, L.

A huge example from the Bay is in the University Museum, measuring about 7 feet antero-posteriorly and 5 feet across the body.

*Trygon pastinaca*, Cuv.

A fully-developed female was caught in the salmon stake-nets on 15th July, 1893. The figure in Day's 'Fishes' is indifferent, and does not show the correct outline of the anterior region—indeed, it is generally defective. The fish is thick.

THE MARINE BIRDS OF ST. ANDREWS †.

Order P E L E C A N I F O R M E S.

Family Phalacrocoracidæ.

*Phalacrocorax carbo*, L. Cormorant.

Not uncommon.

*Phalacrocorax aristotelis*, L. Shag.

Not uncommon.

Family Sulidæ.

*Sula bassana*, L. Gannet.

Common at sea and occasionally close inshore.

Order A N S E R I F O R M E S.

Family Anatidæ.

*Anser anser*, L. Grey Lag-Goose.

Winter visitor.

† I am much indebted to the talented ornithologists, Misses E. V. Baxter, F.L.S., and L. J. Rintoul, F.L.S., for revising this list and adding species and information.



*Anser brachyrhynchus*, Baillon. Pink-footed Goose.  
Winter visitor.

*Branta bernicla*, L. Brent-Goose.  
Winter visitor.

*Branta leucopsis*, Bechstein. Barnacle-Goose.  
Rare.

*Cygnus cygnus*, L. Whooper-Swan.  
Occasional winter visitor.

*Cygnus bewickii*, Yarrell. Bewick's Swan.  
Rare.

*Tadorna tadorna*, L. Common Sheld-Duck.  
Common. Breeds in rabbits' holes on Tentsmuir.

*Anas platyrhynchos*, L. Mallard.  
Common in winter. Eighty years ago it used to frequent the fields within a few miles of St. Andrews, occasionally in such numbers that six have been brought down by a single shot.

*Querquedula crecca*, Teal.  
Common.

*Anas strepera*, L. Gadwall.  
Rare.

*Mareca penelope*, L. Widgeon.  
Abundant in winter.

*Mareca americana*. American Widgeon.  
One occasionally.

*Spatula clypeata*, L. Shoveller.  
Rare.

*Dafila acuta*, L. Pintail.  
Winter visitor in the estuary of the Eden.

*Nyroca ferina*, L. Pochard.

Not uncommon.

*Nyroca marila*, L. Scaup.

Common winter visitor.

*Glaucionetta clangula*, L. Golden-Eye.

Occasionally at the East Rocks in winter.

*Clangula hyemalis*, L. Long-tailed Duck.

Winter visitor.

*Somateria mollissima*, L. Eider-Duck.

Common in the estuary of the Eden and in small groups off the rocks. Is much more common than forty years ago. Breeds on Tentsmuir.

*Somateria spectabilis*, L. King-Eider.

Estuary of the Eden. Rare.

*Melanitta nigra*, L. Common Scoter.

Common winter visitor.

*Melanitta fusca*, L. Velvet Scoter.

Winter visitor.

*Mergus merganser*, L. Goosander.

Winter visitor in small numbers.

*Mergus serrator*, L. Red-breasted Merganser.

Occasionally.

*Mergellus albellus*, L. Smew.

One record from the Eden, 1837.

#### Order ARDEIFORMES.

##### Family Ardeidæ.

*Ardea cinerea*, L. Heron.

Common. Twenty-four herons have been counted fishing in the Eden between Guard Bridge and the Links. A heronry has been formed at Strathtyrum since 1880.



Order C H A R A D R I I F O R M E S.

Family Ædicnemidæ.

*Ædicnemus ædicnemus*, L. Stone-Curlew.  
Rare.

Family Charadriidæ.

*Scolopax rusticola*, L. Woodcock.  
Occasionally.

*Capella gallinago*, L. Common Snipe.  
Winter visitor.

*Capella media*, Latham. Great Snipe.  
Occasionally.

*Lymnocyptes minimus*, Brünnich. Jack-Snipe.  
Occurs late autumn.

*Calidris canutus*, L. Knot.  
Winter visitor.

*Erolia minuta*, Leisler. Little Stint.  
Occasional passage-migrant.

*Erolia maritima*, Brünnich. Purple Sandpiper.  
Winter visitor.

*Erolia alpina*, L. Dunlin.  
Winter visitor, though some breed.

*Erolia testacea*, Pallas. Curlew-Sandpiper.  
Occasional passage-migrant.

*Crœthia alba*, Pallas. Sanderling.  
Passage-migrant.

*Philomachus pugnax*, L. Ruff.  
Not common.

*Tringa totanus*, L. Redshank.

Common from autumn to spring. Breeds on Tentsmuir, and also inland (Forfarshire).

*Tringa nebularia*, Gunnerus. Greenshank.

Passage-migrant.

*Tringa hypoleucos*, L. Common Sandpiper.

Occurs on passage.

*Tringa ochropus*, L. Green Sandpiper.

Occasionally.

*Limosa limosa*, L. Black-tailed Godwit.

Occasionally.

*Limosa lapponica*, L. Bar-tailed Godwit.

Winter-visitor and passage-migrant.

*Numenius arquata*, L. Curlew.

Frequent in autumn and winter. Breeds on Tentsmuir and inland (Forfarshire &c.).

*Numenius phaeopus*, L. Whimbrel.

Passage-migrant.

*Pluvialis apricarius*, L. Golden Plover.

Common in autumn and winter. Breeds on Tentsmuir and inland.

*Squatarola squatarola*, L. Grey Plover.

Passage-migrant. Winter visitor in small numbers.

*Charadrius hiaticula*, L. Ringed Plover.

Resident. Breeds on Tentsmuir. Also winter-visitor.

*Vanellus vanellus*, L. Lapwing.

Resident. Also winter-visitor.

*Hæmatopus ostralegus*, L. Oyster-catcher.

Estuary of the Eden, where mussels abound, except in the breeding-season.



Order LARIFORMES.

Family Laridæ.

*Larus canus*, L. Common Gull.

Abundant. These in large flocks now pass far inland, where formerly none were seen, and they eat corn.

*Larus argentatus*, Pontoppidan. Herring-Gull.  
Common.

*Larus marinus*, L. Greater Black-backed Gull.  
Chiefly winter-visitor.

*Larus fuscus*, L. Lesser Black-backed Gull.  
Passage-migrant.

*Larus hyperboreus*, Gunnerus. Glaucous Gull.  
Scarce winter-visitor.

*Larus ridibundus*, L. Black-headed Gull.  
Very common. Breeds on Tentsmuir.

*Larus minutus*, Pallas. Little Gull.  
Occasionally got.

*Rissa tridactyla*, L. Kittiwake.  
Sometimes seen.

*Sterna hirundo*, L. Common Tern.  
Abundant as summer-visitor. Breeds on Tentsmuir.

*Sterna macrura*, Naumann. Arctic Tern.  
Uncommon. A few breed on Tentsmuir.

*Sterna sandvicensis*, Latham. Sandwich-Tern.  
Passage-migrant.

*Sterna albifrons*, Pallas. Little Tern.  
Summer-visitor. Breeds.

*Catharacta skua*, Brünnich. Great Skua.  
Occasionally.

*Stercorarius parasiticus*, L. Richardson's Skua.  
Occasionally.

*Stercorarius pomarinus*, Temminck. Pomatorrhine Skua.  
Passage-migrant. Occasionally.

Order ALCIFORMES.

Family Alcidæ.

*Alca torda*, L. Razorbill.

Frequent. A large example in the Museum (before 1917) was supposed to be a hybrid between this and the Great Auk.

*Uria aalage*, Pontoppidan. Northern Guillemot.  
Common.

*Uria grylle*, L. Black Guillemot.  
Not uncommon.

*Alle alle*, L. Little Auk.  
Winter-visitor—sometimes in large numbers.

*Fratercula arctica*, C. L. Brehm. Puffin.  
Occasionally.

Order PROCELLARIIFORMES.

Family Thalassidromidæ.

*Thalassidroma pelagica*, L.

After a storm an example was picked up on the West Sands (*E. M.*).

*Puffinus puffinus*, Brünnich. Manx Shearwater.  
Occasionally.

*Puffinus gravis*, O'Reilly. Great Shearwater.  
Sternum found on West Sands, 9 Sept., 1881 (*E. V. B.*).



*Fulmarus glacialis*. Fulmar Petrel.

Occasionally.

Order C O L Y M B I F O R M E S.

Family Colymbidæ.

*Colymbus arcticus*, L. Black-throated Diver.

Occasional visitor.

*Colymbus immer*, Brünnich. Great Northern Diver.

Occasionally during winter. A fine male was captured, whilst diving, in the salmon stake-nets on the West Sands.

*Colymbus stellatus*, Pontoppidan. Red-throated Diver.

Common winter-visitor.

Order P O D I C I P I D I F O R M E S.

Family Podicipidæ.

*Podiceps griseigena*, Boddaert. Red-necked Grebe.

Very rare.

*Podiceps auritus*, L. Slavonian or Eared Grebe.

Occasional winter-visitor.

*Podiceps ruficollis*, Pallas. Little Grebe.

Occasionally.

MARINE MAMMALS.

Order C E T A C E A.

Suborder ODONTOCETI.

*Phocæna communis*, Lesson. .

Common in the Bay, and often caught in the nets for plaice and cod. Occasionally in April an adult female would swim in small circles off the East Rocks accompanied

by its young, or resting at the surface when the latter apparently was suckling. An albino example †, about 4 feet long, was obtained in 1912, and the milk of a female was examined chemically by Prof. Purdie ‡.

A young female,  $31\frac{1}{2}$  inches long and  $8\frac{1}{2}$  inches across the flukes, was procured on June 12th, 1909. From each flipper a black stripe proceeded nearly to the angle of the mandible. No teeth had cut the gum. The dorsal fin was curved to the left side. The contents of the rectum were brownish and semi-fluid as in the child. The umbilical cord was barely 1 inch long and open, the probe passing readily into the abdominal region. Its walls were thin and could have been easily ruptured at this part. This was evidently a suckling porpoise and could not have been long free—in view of the condition of the dorsal fin and the flippers, which were not fully expanded.

#### *Beluga* —?

A single example was seen close to the Gatty Marine Laboratory, and it went southward. It was captured near Cullercoats.

#### *Orca gladiator*, Gray.

A dead male was stranded on the East Sands, whilst an old female drifted near the old (wooden) laboratory alive, apparently enfeebled by age, as the teeth were much worn. The skeletons of both are represented in the University Museum.

#### *Globiocephalus melas*, Trail.

Occasionally observed in the warmer months in the Bay, especially near the salmon stake-nets. One was stranded at the Marine Laboratory, but struggled free before it could be captured.

A brownish whale about 18 feet long (probably this species) was seen off the East Rocks, 14th June, 1898.

#### *Delphinus delphis*, L.

Groups of three to five have been seen now and then in summer, leaping out of water and splashing, as on 15th June, 1898.

† Ann. & Mag. Nat. Hist. ser. 8, vol. ix. p. 117.

‡ *Op. cit.*, Dec. 1885, and 'Chemical News,' Oct. 1885.



*Mesoplodon bidens* †, Sowerby.

A living female specimen came on shore at the West Sands, having been struck probably by a spent shot on one flipper and thus crippled. Its skeleton, heart, &c., are in the University Museum, after a careful description of the former by Sir William Turner ‡.

## Suborder MYSTACOCETI.

*Balænoptera acuto-rostrata*, Fabr.

Occasionally seen in the Bay. An adult female was procured at Crail, and its skeleton is in the University Museum §, as well as a cast of a dissected flipper from the British Museum.

*Balænoptera physalus*, L.

An example, 64 feet long, was beached at the Whale Rock (East Rocks) in the early forties of last century. Only blades of its whalebone occur in the University Museum.

## Order PINNIPEDIÆ.

## Family Phocidæ.

*Halichærus grypus*, Nilsson.

A young example was captured at the East Rocks, and was preserved by Mr. Thomas Walker, late Curator of the University Museum. It is now in the Perth Museum.

*Phoca vitulina*, L.

Frequently noticed in the Bay as well as in the estuaries of the Eden and the Tay, where its depredations on the salmon necessitate special measures. Young examples are occasionally caught in the cod- and plaice-nets.

† Ann. & Mag. Nat. Hist., Dec. 1908.

‡ Proc. Roy. Soc. Edin. vol. xxix. pp. 687-720, with 11 text-figs. (1910).

§ Jour. Zool. Research, May 1917, pp. 37-73, pls. i.-v.







